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ABSTRACT

This paper examines Raven's Colored Progressive Matrices Scale (CPM) IQ test which is considered by many to be "culture fair." The emphasis is on socioeconomic status but factors of sex and ethnicity are also considered. Two major studies from which socioeconomic status data can be extracted are examined. These and other studies found that children from more affluent backgrounds do better on the CPM than socially disadvantaged children of the the same age groups. On the issue of ethnicity, it was found that, on the whole, white children tested higher. Further, some studies show that boys do better on the test than girls. In comparing CPM to other tests, it was found that paired associative learning tasks may be less socioeconomically biased than the CPM and that CPM correlated highest with the Block Design subtest of the Wechsler Intelligence Scale for children (WISC), a test of abstract spatial thought. Tables are included presenting some of the data and a list of references is appended. (CG)

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"CULTURE-FAIR" MENTAL ABILITY TESTING WITH SCHOOLCHILDREN: A REVIEW OF THE SILENT RAVEN; ADEQUATE IF USED WITH CAUTION

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"CULTURE-FAIR" MENTAL ABILITY TESTING WITH SCHOOLCHILDREN:

A REVIEW OF THE SILENT RAVEN;

ADEQUATE IF USED WITH CAUTION

Because of the issue of test bias, contemporary psychologists - who have been intimately involved with intelligence and IQ tests since their inception - have searched for a "culture-fair" test of cognition for schoolchildren. Raven's Colored Progressive Matrices Scale (revised order, 1956, booklet form; hereafter referred to as the CPM) was thought by some to be the panacea. This notion will be examined in this paper since a rather comprehensive search of the literature was done. The emphasis will be on socioeconomic status (SES) as this has been the major thrust throughout, but the important factors of sex and ethnicity will be explored since they are major variables that impinge upon the results of a test administration. Then, the two major CPM studies where SES data can be extracted will be scrutinized.

The CPM Scale.

The CPM is actually a test of spatial analogies. The analogies become progressively more difficult, and problem solving initially requires the ability to comprehend "serial changes" which can be grasped by young children. As the matrices become more sophisticated, recognition of "productive changes," which is the most frequent mode of response by adults, is necessary (Raven, 1956).

The CPM is an untimed test consisting of a series of designs (36) each with a piece missing. The child selects from six pieces the one that best fits the design.

Raven (1956) wrote that:

> The CPM can be used satisfactorily with people who...cannot understand

> or speak the English language, with people suffering from physical disabilities, ...or deafness, as well as with people who are intellectually sub-normal or have deteriorated. The scale as a whole can be described as a test of...clear thinking.

He cautions against the use of the CPM as a sole measure of global intelligence, and insists that it be used with a standardized test of vocabulary for an overall measure of intellectual functioning. Koppitz (1975) describes the CPM as a test of visual-perception and nonverbal reasoning. She further wrote that it is of particular value in assessing perceptual integration of youngsters with fine-motor impairment. Birkmeyer (1965) concluded that the CPM can be used with confidence to measure a child's visual-perceptual abilities and it can indicate a trend of overall ability.

So here is a test which at first glance would not seem to favor any particular ethnic, class, cultural, or gender group. There are no environmental objects present which might be more common to one group than another. There are no letter, number, or other seemingly semiological aspects. The test is not reliant upon verbal factors or dexterity. Depth perception is not even a factor, only two dimensional visual design stimuli are utilized.

SES Differences.

The evidence shows overwhelmingly that those children from more affluent backgrounds do better on the CPM than the socially disadvantaged of the same age groups.

Concerning the CPM, Sperrazzo and Wilkins (1959) wrote that it is surprising that a relatively nonverbal performance test is demonstrably sensitive to differences in SES. Cantwell (1967) found significantly better scores on the CPM

by children from a stable neighborhood of reasonable economic background than by children from less advantaged families in New York City.

She further stated that both groups yielded similar score distribution patterns. Jensen and Rowher (1970) wrote that SES is a major variable in CPM performance. Tuddenham, Davis, Davidson, and Schindler (1958) discovered that differences between upper middle-class and working-class schools are substantial and highly significant. Sperrazzo and Wilkins (1958) established significant differences between socioeconomic levels. Green and Rowher (1971) obtained clear differences on the CPM favoring the higher groups. All the studies that dealt with SES per se as a performance factor demonstrated that higher SES children produce a higher mean CPM score over low SES children.

The regular age usage for the CPM is for children ranging from the Kindergarten year to preteens. Raven's Standard Progressive Matrices Scale (SPM) is an upward extension of the CPM. Employing the SPM, Bernstein (1959) found that English middle-class teenage boys performed better than those of lower-class homes.

Of great interest was that paired associative learning (PA) tasks with verbal noun pairs reveal virtually no SES bias as compared to the CPM. There were negligible differences on PA tasks between SES groups, but group differences on the CPM were significant (Green and Rowher, 1971). PA measures reveal a population difference only at the Kindergarten level, whereas the CPM showed a better performance by high SES students at all levels tested, which included first and third grades as well as Kindergarteners (Rowher, Ammon, Suzuki, and Levin, 1971).

Ethnicity.

Beiser (1972) wrote that:

> SES, rather than race per se, is usually considered the important variable. The points concerning race and SES raise many questions about methodology (which have not been satisfactorily answered).

Nevertheless, some researchers claim that whites clearly obtain higher mean CPM scores than blacks (Higgins and Sivers, 1958; Jensen, 1974, see Table 3 page 27). Jensen and Rowher (1970) further assert that the hypothesis that the white-black difference which is mainly attributable to culture bias was not supported by their data. However, Jensen made no mention at all of matching his subjects in his huge 1974 study in Riverside, California; even though Mexican-Americans (Chicanos) and blacks in Riverside tend to be poorer than their white neighbors as elsewhere in the USA (Mercer, 1972). Jensen (1974) also wrote that neither the CPM or the Peabody Picture Vocabulary Test (PPVT) are biased against black schoolchildren, but the PPVT is not culture-fair for Chicanos. Jensen's (1972) position is quite obvious in terms of his personal bias, and he even offers a solution for the inequality of measured IQ via eugenics:

> Differences Consistently found between groups (e. g., the 15 point differences between the mean IQ of whites and the mean IQ of blacks) may in fact be genetically based and that attempts to decrease these differences may necessitate employment of biological techniques rather than...education.

Other studies reveal mixed results. Sperrazzo and Wilkins (1958), using 480 St. Louis children ranging in age from 7- to 11-years from three different SES backgrounds, found that racial differences were stronger among upper- and middle-class students in favor of whites. However, they show that there was no

significant difference between lower-class racial groups, but lower-class whites scored slightly higher. They wrote that they were not surprised that "race differences" in "intelligence" test scores are found with a test (the CPM) that is sensitive to variations in socioeconomic background. Semler and Iscoe (1966) found that even though white subjects had higher WISC Full Scale IQ's than blacks at all SES levels and higher CPM scores at the 7-year level in their study, blacks performed better on the CPM at the 8- and 9-year levels.

One study found that with middle-class students, blacks scored slightly higher than whites on the CPM (M. G. Cline, unpublished data, personal communication; in Tulkin and Newbrough, 1968).

The IQ level for 96 Navajo Indian children with various degrees of white schooling was lower on the CPM than on Goodenough's Draw-A-Man Test scores. The correlation between these two instruments in this study is low. Poor performance on the CPM with this population is consistent with findings of other Native American groups (Norman and Midkiff, 1955).

Sex Differences.

Cantwell (1967), utilizing 1534 second through fifth grade pupils from both lower-and middle-class groups, demonstrated that boys achieved superior mean scores over girls with both SES groups and at all grade levels. Jensen (1974) found that males did better than females on the CPM in three ethnic groups (blacks, whites, and Chicanos). Jensen's study included 1663 subjects with an age range from 6- to 12-years. Referring to the work of Semler and Iscoe (1966), Jensen

(1971) showed a sex difference in favor of the boys, with a larger sex difference for whites than for blacks. This population sample had an age range of 5- to 12-years.

Kerr (1972) examined a number of determinants of visual-motor coordination and visual-perceptual reasoning in 256 5- to 9-year olds using the Bender Gestalt Test and the CPM. His results indicate that visual-motor coordination and visual-perceptual reasoning performance were significantly affected by achievement and grade level, but not by sex.

CPM Correlations To Other Tests.

Martin and Wiechers (1954) found a correlation of .91 between the WISC (Wechsler Intelligence Scale for Children) Full Scale IQ and CPM scores. Surprising though, is that the WISC Verbal IQ correlated higher (.84) than the WISC Performance IQ (.83), but only by one point. However, the Block Design Test, which is part of the Performance Scale, showed the highest correlation (.74) of any individual subtest within the whole scale. The other correlations for the remaining tests, in descending order, are: Object Assembly and Vocabulary (.73), Comprehension (.70), Arithmetic (.66), Picture Completion and Similarities (.62), Coding (.60), Picture Arrangement (.58), and Information (.47). Subjects were 100 9-year old Indiana schoolchildren, 60 boys and 40 girls, with a mean WISC Full Scale IQ of 107 that ranged from 74 to 141 and a standard deviation of 16.1. Their CPM scores ranged from 8 to 35 with a mean of 25.3 and a standard deviation of 6.5.

Birkmeyer, in two separate studies, produced mixed results between the CPM and the WISC using Spanish-speaking white and Spanish-speaking black children.

In 1964, correlations were Full Scale .51, Verbal .41, and Performance .50 with the blacks. Associations for the whites were Full Scale .62, Verbal .55, and Performance .66. The following year, black correlations were Full Scale .40 and Performance .74. With whites, associations were Full Scale .22 and Performance .70.

Semler and Iscoe (1966) and highly similar CPM and WISC intercorrelation matrices for whites and blacks at age levels 7-, 8-, and 9-years.

Birkmeyer (1964) found a significant association of .51 with the Stanford-Binet Intelligence Scale and the CPM for Spanish-speaking black children, but not with Spanish-speaking white children (only .32). Yet Higgins and Sivers (1958) found that for 789 black and white children of low SES with an age range of 7- to 9-years who attained similar mean Stanford-Binet scores, the black subjects scored significantly lower on the CPM. They suggested that the CPM cannot be considered a test of intelligence or a measure of "G," but a measure of a specific skill. Their findings indicate that intelligence tests heavily loaded with nonverbal items may discriminate against black children.

The Jordan and Bennett (1957) study contains data that suggested that the CPM is of less value for lower age groups. They studied 200 children entering first grade using "the conventional upper and lower 27% technique." It was found that 22 items appear to be too difficult for the age group studied, which effectively reduces reliability since fewer items are applicable. Also pertaining to very young pupils, McNamara, Porterfield, and Miller (1969) found that the CPM is not as good as the Bender Gestalt Test for WPPSI (Wechsler Preschool and Primary Scale of Intelligence) correlations. Obtained correlations indicated the Bender is highly correlated for performance areas on the WPPSI and may be more appropriately interchanged than the CPM for obtaining estimates of WPPSI Full Scale IQ's.

Discussion of Data in Tables 1 and 2.

Cantwell (1967) did the largest study specifically looking at SES differences in American schoolchildren. Her subjects were all living in New York City. Most of the middle-class ones were white, and most all of the working-class group were black, but at every age level the children from the more affluent score higher. See Table 1 below.

Insert Table 1 about here

The Jensen (1974) study was done in Riverside, California. As was already mentioned, Jensen and Rowher knew in 1970 that SES was a major variable in CPM Performance, but simultaneously asserted that the black-white score discrepancy was not due to culture bias according to their data. The Chicano and black children in the 1974 study were not matched for SES with the more affluent whites. The whites in Riverside fit the usual description of middle-class while most of the blacks and Chicanos do not (Mercer, 1972). This writer contends that Jensen's (1974) findings are purposely misleading in regards to race and intelligence, but his results here further confirm Cantwell's regarding SES. Refer to Table 2 below.

Insert Table 2 about here

These are the two largest known studies on the CPM and American schoolchildren and the results are basically the same. The poorer the family, the lower the score. In fact, the lower-class children tend to perform two years or more below their middle-class counterparts at every age level. This is a substantial score discrepancy on what initially seems to be a non-biased test. There has never been a study done that shows that lower-class children do better on the CPM.

It would probably be very safe to assume that this holds for all IQ tests as well, demonstrates a class bias of IQ tests, and does not prove genetic intellectual inferiority.

Conclusion.

There are certain factors which affect CPM performance, the most prominent being socioeconomic status, in favor of the more affluent since the low SES children display a cognitive lag on the CPM. Sex also seems to be a critical factor in favor of boys, but this may be a cultural artifact because of ascribed sex roles in our society and not based upon innate male superiority for this task. Young girls often surpass boys on verbal tasks, again, possibly due to ascribed gender roles and rearing practices. The issue of ethnic superiority has not been proven, although minorities generally score lower. It appears that the CPM is neither a "class-fair" or "gender-fair" test.

It seems as though paired associative learning (PA) tasks may be less SES biased than the CPM, and this possibility deserves further inquiry. However, it may be that PA tasks, when using verbal noun pairs, are a better measure of school achievement; wheras the CPM may be the best single measure of untimed, non-motor, nonverbal cognitive ability that is currently available.

It seems logical that the CPM should correlate highest with the Block Design subtest of the WISC which is basically a test of abstract spatial thought, although the CPM does not measure exactly the same mental processes since it tests the ability to respond to nonverbal analogies and may also be more complex. Along the same lines, it is not surprising that the WISC Information subtest, which

measures factual knowledge, correlates lowest among all WISC subtests.

Norms that are used across cultures or even communities are not entirely adequate due to varying "cultural exposure," which includes various educational systems, and for many purposes local norms are better suited.

There is a linear increase in CPM proficiency by both age and grade level.

The structure of an individual's thought probably is dependent upon the dominant type of activities which take place within the culture where the individual resides. This, in turn, will affect how a person will perform on a given task. Abstract thought will be more common in technological societies where theoretical thinking is valued and required.

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TABLE 1

Cantwell's (1967) CPM Means by School Grade Level and SES[1,2]

	Middle-Class				Working-Class			
Grade	Age[3]	Mean	SD	n	Mean	SD	n	
2	7	21.06	6.03	173	16.88	4.44	216	
3	8	23.67	5.41	183	18.26	5.25	248	
4	9	26.85	5.39	179	18.91	5.48	169	
5	10	28.28	5.69	192	22.10	5.79	174	
		Totals		727			807	N=1534

TABLE 1a

Ethnic Group Membership by SES[1]

By Percent	Middle-Class	Working-Class
White and Other	94	3
Black	3	94
Puerto Rican	3	3
Totals	100	100

[1]Cantwell (1967), New York City, New York.

[2]CPM Administered during October and November.

[3]Grade level converted to age equivalence by using a constant of five plus grade by this writer for comparison purposes with Table 3 on next page.

TABLE 2

Jensen's (1974) CPM Means by Ethnicity and Age[1]

Age	Ethnic Group: White			Black			Chicano		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
6	14.6	4.1	91	11.9	3.0	64	12.6	4.0	110
7	18.7	5.2	143	15.0	4.6	76	14.5	4.0	84
8	23.1	6.3	79	15.4	5.9	66	16.6	5.1	91
9	25.8	6.5	96	18.7	5.4	42	19.2	6.4	89
10	27.3	5.2	83	20.0	5.8	55	21.2	6.3	83
11	28.4	4.9	71	22.6	7.0	45	24.0	5.6	81
12	29.0	6.8	69	24.4	7.7	27	25.8	7.0	68
Totals			638			381			644 N=1663

TABLE 2a

Subjects by Sex and Ethnicity[1]

By Number	Male	Female	Totals
White	333	305	638
Black	183	198	381
Chicano	334	310	644
Totals	850	813	1663

[1]Jensen (1974), Riverside, California.